

REMARKS

In the last Office Action, the Examiner rejected claims 1, 3, 4, 8 and 9 under 35 U.S.C. §101 as being directed to non-statutory subject matter. Claims 2 and 6 were allowed by the Examiner.

Applicants and applicants' counsel note with appreciation the indication of allowable subject matter concerning claims 2 and 6. However, for the reasons noted below, applicants respectfully submit that independent claim 1, dependent claims 8-9, and amended independent claims 3-4 are in compliance with 35 U.S.C. §101 and also patentably distinguish from the prior art of record.

In accordance with the present response, each of independent claims 3 and 4 has been amended to overcome the rejection under 35 U.S.C. §101 by reciting with more specificity the system identification technology from which the mathematical model used in the method of designing the disturbance estimated-type control system is prepared. The rejection of independent claim 1 and corresponding dependent claims 8-9 under 35 U.S.C. §101 is being traversed as set forth below without further amendment to claims 1 and 8-9.

Applicants request reconsideration of their application in light of the following discussion.

Brief Summary of the Invention

The present invention is directed to a disturbance estimated-type control system, a gas compressor control system, and a method of designing a disturbance estimated-type control system.

As described in the specification (pages 1-8), conventional disturbance estimated-type control systems have been influenced by parameter variations, including heat load and rotational speed variations, which affect the operation and performance of the control systems.

The present invention overcomes the drawbacks of the conventional art. Figs. 1-5 show an embodiment of a disturbance estimated-type control system according to the present invention embodied in the claims. The disturbance estimated-type control system has a control object 101 (e.g., a gas compressor) based on a mathematical model (shown in Figs. 1-2) comprised of one of a state equation and a transfer function and prepared by system identification technology as described, for example, on pgs. 26-28 of the specification. A disturbance estimating device 109 is based on an expansion system based on the mathematical model and estimates a disturbance 103 of the control object 101 in accordance with an input signal 105 (e.g., a displacement control command value) inputted into the control object 101 and a detection signal 107 (e.g., a detected temperature at the outlet of an

evaporator) detected from the control object 101. A compensating device 115 is based on the mathematical model and compensates for a deviation between the detection signal 107 and a target value 111 and outputs a corresponding control signal. A subtractor 117 subtracts the control signal of the compensating device 115 from a disturbance estimated value of the disturbance estimating device 109.

In other aspects, the present invention is directed to a method of designing a disturbance estimated-type control system utilizing the mathematical model, disturbance estimating device, and compensating device and corresponding functions described above with respect to the disturbance estimated-type control system.

By the foregoing construction, the disturbance estimated-type control system according to the present invention is insensitive to parameter variations, such as heat load and rotational speed variations, resulting from changes in physical property values. Likewise, by the method according to the present invention, a disturbance estimated-type control system is designed with high efficiency as compared to the conventional art.

Traversal of Rejection Under 35 U.S.C. §101

Claims 1, 3, 4, 8 and 9 were rejected under 35 U.S.C. §101 as being directed to non-statutory subject matter.

The Examiner contends that the claimed invention is directed to solely an abstract idea or to manipulation of abstract ideas. The Examiner further contends that while directed to the technological arts, the claimed invention is devoid of any limitation to a practical application in the technological arts (i.e., the claimed invention does not produce a useful result).

Applicants vigorously disagree with the Examiner's rejection of claims 1, 3, 4, 8 and 9 under 35 U.S.C. §101 as being directed to non-statutory subject matter. The Examiner has not met his burden of establishing a prima facie case that the claimed invention, as a whole, is directed to solely an abstract idea or to manipulation of abstract ideas and that it does not produce a useful result. In concluding that the claims are directed to non-statutory subject matter, it appears that the Examiner has relied upon individual aspects of the claimed invention and has not construed the claimed invention as a whole. Diamond v. Diehr, 450 U.S. 175, 209 USPQ 1, 9 (1980).

For subject matter to be statutory, a claimed product must define a useful machine or manufacture which has a practical application in the technological arts, and a claimed process must be limited to a practical application of an abstract idea or mathematical algorithm in the technological arts. In this case, the claimed invention as a

whole recited in independent claim 1 is directed to a combination of interrelated elements which form a disturbance estimated-type control system that is insensitive to parameter variations. Likewise, the claimed invention as a whole recited in each of independent claims 3-4 is directed to a combination of steps which produce a method of designing a disturbance estimated-type control system that is insensitive to parameter variations. The claims are not drawn to isolated mathematical concepts which may be characterized as "abstract ideas," but rather are directed to a specific system and specific methods which are limited to specific applications producing useful, concrete, and tangible results.

Moreover, independent claim 1 is an apparatus claim which contains limitations drafted in means-plus-function format. Those limitations are therefore limited according to 35 U.S.C. §112, sixth paragraph, to structure disclosed in the specification and equivalent structures. The U.S. Court of Appeals for the Federal Circuit has determined, in banc, that claims written in means-plus-function format contain statutory subject matter even if functional phrases of the means limitations recite mathematical calculations. In re Alappat, 31 USPQ2d 1545, 1558 (Fed. Cir. 1994). Thus independent claim 1 does not wholly preempt the use of mathematical calculations because claim 1 is limited to the structure disclosed in the specification and equivalent structures for performing the claimed functions.

Moreover, independent claims 1, 3 and 4 are directed to statutory subject matter for the same reasons that the Examiner has determined that allowed independent claim 2 is directed to statutory subject matter. Independent claim 1 is directed to a disturbance estimated-type control system and constitutes a broader version of allowed independent claim 2. More specifically, independent claim 1 is not limited to a variable displacement type gas compressor, as recited in claim 2, but rather more broadly recites a "control object" which is based on a mathematical model comprised of one of a state equation and a transfer function and prepared by system identification technology. Both allowed claim 2 and rejected claim 1 require disturbance estimating means, compensating means and subtracting means and corresponding functions. Each of independent claims 3-4 is directed to a method of designing the disturbance estimated-type control system of claim 1.

Nevertheless, in order to expedite prosecution of the application, each of independent claims 3 and 4 has been amended to recite with more specificity the system identification technology from which the mathematical model used in the method of designing the disturbance estimated-type control system is prepared. More specifically, each of amended independent claims 3 and 4 requires the steps of preparing a mathematical model of the control object (e.g., a displacement varying mechanism of a variable displacement-type

compressor) by inputting a control signal into the control object, measuring an output signal (e.g., an air temperature at an outlet of an evaporator converted to a voltage) from the control object resulting from the control signal inputted into the control object, and performing, based on the output signal, identification with an identification program to establish an evaluation. These steps relating to the system identification technology of the present invention are supported by the specification and drawings as originally filed (pg. 16, lines 13-16; Fig. 5 and pg. 26, line 15 to pg. 27, line 9; and pg. 28, line 19 to pg. 29, line 8).

In view of the foregoing amendments and discussion, applicants respectfully submit that the rejection of claims 1, 3, 4, 8 and 9 under 35 U.S.C. §101 has been overcome and should be withdrawn.

In view of the foregoing amendments and discussion,
the application is believed to be in allowable form.
Accordingly, favorable reconsideration and allowance of the
claims are most respectfully requested.

Respectfully submitted,

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